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DISFLUENCIES AS A FUNCTION OF HEARING ONE'S OWN VOICE  
ON A TAPE RECORDER

By

Susan Nelson Pier

B.A. University of Calgary, 1967

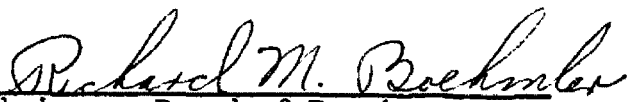
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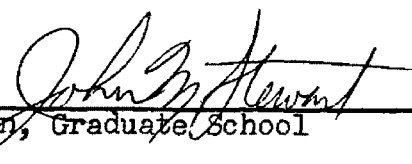
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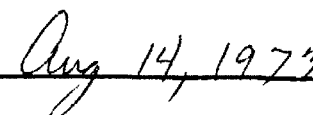
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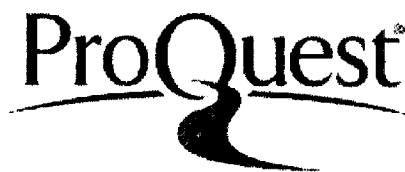


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## CHAPTER I

### INTRODUCTION

#### Background

Most people have encountered or have discussed at some time the experience of hearing one's own voice on a tape recorder. People tend to react differently to the experience of listening to their voices on a tape as compared to listening to their voices while they speak. Although friends may insist that the taped voice sounds exactly like the person's voice, people seem to believe that their recorded voices are very different from what they think they sound like, resulting in such statements as: "Is that really how I sound?", "That's not me, is it?", or "It's horrible. Turn it off!!!"

Recently there has been study of the reaction to hearing a recording of one's own voice. Holzman and Rousey (1966) revealed that women, who listened to their own recorded voices, experienced more emotional disturbances, involving: (1) awareness of the difference between subjects' expectations of how their own voices would sound and the actual experience of hearing their own voices, (2) attention focused on vocal qualities rather than grammatical or personological qualities, and (3) a defensive negation of the voice listening experience, than when subjects in a comparison group listened to other recorded voices. Later, Holzman, Rousey and Snyder (1966) revealed

that when male subjects listen to their own voices, they show greater activation of physiological responses, such as vasoconstriction of the fingertip, increased action potentials of the frontalis muscles and increased GSR, than when listening to other voices. Higher physiological activation, as a result of hearing one's own voice, occurred regardless of whether or not subjects recognized their own voices. The study further indicated that male subjects show more constricted free associative output after hearing their own voices, rather than after hearing some other voice.

Bilingual subjects, listening to their own voices in their native tongue and in their later learned language showed greater affective reactions, more speech disturbances and more defensive negation to hearing themselves speak their own native language, than to themselves speaking their secondary language (Holzman, Berger, and Rousey, 1967). Judgments of speech disturbances were based on Mahl's Verbal Behavior Disturbance Level (Mahl, 1963), which were modified into the following categories:

1. Non-ah ratios
  - a. Sentence change, e.g., "that was . . . it will be one year ago."
  - b. Omission of part of words or entire words: e.g., "She mour was in mourning."
  - c. Negative words.
  - d. Repetitions, e.g., "He was he was going."
2. Ah disturbances, e.g., "eh," "ah," "uh," "uhm."
3. Self-reference, e.g., "I have the impression . . ."

In these studies, one explanation of the appearance of emotion and defense in response to hearing one's own taped voice involves a bone-versus-air conduction theory (Bekesy, 1949). The hearing of one's own voice by bone conduction is of the same magnitude as concurrently hearing by air conduction. In the hearing of a voice on a tape recorder, the bone-conducted components of the sound, present when one hears one's self speak, are largely eliminated, thereby altering the quality of the voice. Such altered quality may result in an experience of unfamiliarity with the recorded voice. Therefore, such a reaction, as noted in these experiments, could result.

Another explanation of a person's emotional response to hearing his/her own voice, given by Holzman and Rousey (1967), is that the person is suddenly confronted with the paralanguage and suprasegmental phonemes in his verbal language which, until that moment, they were not aware they had expressed. Holzman (1971) believes that an individual ceaselessly monitors his voice to censor certain pitch levels, stress and/or juncture patterns (suprasegmental phonemes) or vocal segregates (paralanguage) which he does not want expressed and then represses the qualities, which he has been trying to censor. Thus, when one hears his recorded voice, he is left momentarily defenseless. Holzman (1971) further advocates that following the initial shock of hearing one's own voice, the subject begins to show a retroactive defensiveness, that is, denial of what was heard and disavows that which was heard and which was disturbing.

Whatever the reason, there seems to be a consistent pattern of subjects reacting emotionally to hearing their own voices. Further,

researchers have also found that a higher physiological reaction, which is associated with increased emotion, is also related to the speech act in both stutterers and non-stutterers. Fletcher (1914) revealed an increase in pulse rate and a plethysmographic decrease in the finger blood volume during speaking by stutterers. Valyo (1964) showed that, in silence GSR recordings showed no difference between stutterers and non-stutterers, but during speech the stutterers' GSR's doubled while the non-stutterers showed no change.

Other studies have shown that stuttering behavior can be associated with conditioned anxiety. Hill (1954) found that normal subjects revealed increased stuttering behavior, accompanied by increased muscle action potentials, when they were exposed to a red light, which had been previously associated with a shock presentation. Hasbrouck (1969) showed that male non-stutterers produced more disfluencies and increased GSR, when shock was paired intermittently with the production of a specific sound at the beginning of a word.

Studies have also shown that disfluencies occur during differing emotional situations during the speech of both adults and children. Mahl (1963) has shown with normal speakers that filled pauses (e.g., ah) do not occur as often in the stress of psychiatric interviewing as they do in ordinary speaking, while the hesitation phenomena (e.g., non-ah) occurs more under profound emotion. Olson (1969), in studying a normal speaker's reactions in an induced anxiety period and a neutral period, revealed further that verbal disturbances were greater in an induced period as compared to a neutral period. Induced anxiety periods and neutral periods were produced by asking the subjects

stressful and nonstressful questions. Inferred anxiety behavior patterns can also occur in children. Investigations by Davis (1939, 1940) revealed that the speech of normal young children in free-play will have approximately 49 instances of repetitions for each 1,000 words spoken. It should be noted that the repetitions, which Davis observed, appeared to be functionally related to such activities as attention getting, coercion, status seeking, criticism, seeking a privilege and obtaining social acceptance. It is reasonable to assume that at various times a degree of negative emotion existed, as a result of interpersonal activity occurring in the free-play situation.

The relationship between physiological and psychological reaction and fluency appears to differ from males to females. Hasbrouck (1969) revealed that males are more susceptible to the maintenance of disfluencies than females, when either no shock, intermittent shock or continuous shock was paired with the production of a specific sound. Davis (1939, 1940) also stated that among the non-stutterers investigated, boys were more likely than girls to be disfluent. Thus, it appears evident that stuttering behavior occurs differently in males and females.

Investigations of difference in the reactions of normal subjects and subjects with speech and/or voice disorders (no stutterers), after listening to their own recorded voices, was conducted by Weston and Rousey (1970). Both male and female subjects with speech defects showed a greater emotional reaction to hearing themselves, than did the male and female subjects without speech defects. Female subjects, with or without speech defects, showed a significantly greater semantic

differential rating to hearing their own recorded voice, than did the female control group, who rated their semantic differential reaction without hearing any recorded voice sample. Such results are similar to those in previous studies (Holzman, Berger and Rousey, 1967; Holzman and Rousey, 1966; Holzman, Rousey and Snyder, 1966; Rousey and Holzman, 1967).

Since emotion is associated with hearing one's own voice, since disfluencies seem to be associated with emotion and since these relationships vary from males to females, it is plausible that disfluencies would be associated with hearing one's own voice, and that males and females would have a differing relationship. If such a relationship is significant, such information may be beneficial in research regarding the development of stuttering and in the area of stuttering therapy. With the advent of audio-visual teaching methods in the school and in the clinical setting, research on the relationship between the hearing of one's own voice on a tape recorder and the production of speech disfluencies, may provide applicable results to both situations. If the hypothesized relationship between speech disfluencies and the hearing of one's own voice is plausible, the school teacher should be aware of it, since the tape recorder is increasingly used in classroom activities. If the teacher is aware of the possible relationship between speech disfluencies and hearing one's own voice, the teacher would not be concerned about the increased disfluency output and, therefore, the teacher would not perpetuate a real disfluency problem by bringing the child's increased disfluencies to her/his attention.

If the proposed relationship between speech disfluencies and listening to one's own voice is verified, the stuttering clinician should be cognizant of it. The speech clinician, in traditional stuttering therapy, works directly with the stutterer, although the procedure may involve tape recording and/or video taping of the session, which would be played back to the client. Recently, a new home-based tape recorder method (Peins, McGough and Lee, 1972), which involves presenting daily therapy sessions on one tape and recording the client's responses on another tape for their later analysis, has been introduced as a method of stuttering therapy.

As people with communication disorders appear to react more emotionally to their own recorded voices than do normal speakers (Weston and Rousey, 1970), speech clinicians should be aware of the possible relationship between the client's increased speech disfluency output and his hearing of his own recorded voice whether he is receiving articulation, voice or stuttering therapy. If the clinician is unaware that such a relationship is occurring, the client may not be provided with the therapy necessary to desensitize himself to the hearing of his own recorded voice. The speech clinician should be especially aware of the possibility of an increase in a stutterer's disfluencies as a function of his hearing his own recorded voice, which may compound the total number of disfluencies occurring in the client's speech, and in turn, thus influences the clinician's judgment of the severity of the disfluency problem. If Holman and Rousey's (1966) research is valid and related reliably, the client may eventually adapt to hearing his own voice, which may again influence the clinician's



judgment of the fluency problem, for the stutterer's disfluency output may decrease after adapting to the hearing of her/his own voice. Therefore, examination of the possibility that disfluencies may be associated with the hearing of one's own voice on a tape recorder, may have value to clinicians in the field of speech pathology.

### Statement of the Problem

From the research cited to this point, certain expectations can be generated concerning the speech effects, which could result from a person's listening to a recording of his own voice. These expectations involve the following:

1. If the past research has been reliable in showing that physiological and psychological reactions do occur after a subject listens to her/his own recorded voice and that physiological and psychological reactions do occur when a subject produces disfluencies, then it appears plausible that a larger number of speech disfluencies would occur in a subject's speech after hearing her/his own recorded voice, than would occur after hearing other recorded voices.

2. If female subjects show more affective reaction to hearing their own recorded voices than do male subjects, as indicated in the above research, then it appears credible that female subjects will show a greater change in the amount of disfluencies following listening to their own recorded voices compared to the amount of disfluencies following listening to another voice than would the male subjects.

3. In view of the past research, it appears likely that male subjects will reveal a greater number of disfluencies following

listening to other recorded voices than the number of disfluencies exhibited by female subjects following listening to other recorded voices.

### Hypotheses

It was hypothesized that the data collected would lead to the rejection of the null hypothesis: A subject will have the same number of disfluencies in her/his speech following listening to a recorded sample of her/his own voice, as the number of disfluencies produced following listening to recorded samples of other voices.

It was further anticipated that the data collected would lead to the rejection of the null hypothesis: There will be no interaction between sex groups and recorded voice conditions. Any interaction effect would be due to female subjects showing a greater change in the number of disfluencies following listening to their own recorded voice compared to the number of disfluencies following listening to another voice than would be shown by the male subjects.

It was further anticipated that the null hypothesis: Both sex groups will have the same number of disfluencies in her/his own speech following listening to recorded samples of other voices, would be rejected. It was difficult to predict whether or not there would be a difference in the amount of disfluencies for both sex groups, following listening to a recorded sample of their own voice, because of the interaction effect hypothesized above.

### Definitions of the Experimental Variables

The independent variables were: (A) Sex variables: (1) male and (2) female; and (B) voice variables: (1) hearing a sample of one's own recorded voice and (2) hearing samples of other voices. The dependent variable was the total number of disfluencies per one hundred words, occurring in each subject's speech, following the respective voice sample.

Listening to recorded voice samples involved having each male and female subject listen to twenty taped questions; four of which were recorded in the subject's own voice and the remainder of which were recorded in voices of peers, who were the same sex as the subject and who were not experimental subjects.

Subject's disfluent speech involved any interruption in the subject's pattern of speech response, according to Johnson, Darley and Spriestersbach's classification of disfluencies, as the subject responded to the taped questions in part two of the experiment (Appendix C).

## CHAPTER II

### METHOD

#### Subjects

The study involved twenty mono-English subjects, ten males and ten females, who were randomly selected from three grade seven classrooms in two different public schools, Bonner and Target Range. Subjects were selected from these schools because the overall socio-economic status of the pupils was similar in the two schools. Each subject was given screening tests by the experimenter to determine whether or not each subject's speech, language and hearing abilities were within normal limits.

#### Procedures

Each subject was individually tested in a sound treated room, with a one-way mirror, in the Speech and Hearing Services' mobile unit, by a female experimenter. Before beginning the experiment, the subjects were asked if they had ever had a hearing test or had received speech therapy before. Subjects were then given an audiometric pure tone screening test at 250 Hz, 500 Hz, 1,000 Hz, and 2,000 Hz, and were asked to read aloud a selection involving all the speech sounds. If the experimenter judged a subject's speech and language abilities not within normal limits or her/his hearing ability was not better

than 15 dB H.L. (ISO 1964 standard), the subject was replaced by a subject with normal speech, language and hearing abilities.

After the screening tests, the experimenter provided the subjects with a sheet containing the appropriate typed instructions for part one of the experiment (Appendix A). In the first part of the experiment, the twenty subjects were randomly assigned questions to read aloud. The ten questions were typed on separate pieces of paper and lying face down on a table in front of them (Appendix B). As each subject read aloud the questions, they were recorded from the observation room as "own voice" presentations in part two of the experiment. Sixteen additional questions were randomly assigned to sixteen non-experimental peers and served as "other voices" presentation in part two of the experiment.

All experimental questions were randomly chosen from 50 questions which were constructed on the basis of Olsen's (1969) "neutral questions." All questions used in the experiment were reviewed by a University of Montana education professor, Dr. G. Millis, who is in charge of social science curriculum for the junior high level, to help assure that the questions were not difficult for grade seven students to answer.

After a period of three to seven days, all subjects participated in part two of the experiment, which took place in the same experimental room and the subject received a new typed instruction sheet to read (Appendix A). In the instructions, the subjects were told that they would hear their own voice, to reduce the possibility of a "startled response" to hearing their own voice. The subjects were

then presented with a tape recording of twenty different questions, sixteen of which were spoken by sixteen grade seven participants of the same sex as the subject, but who were not experimental subjects, and four of which were spoken by the subject herself/himself (Appendix B). Each subject's four questions were randomly chosen from the ten questions, which she/he previously read aloud in part one and these four questions were randomly ordered in every group of four questions with the sixteen other questions, so that no subject at any time heard her/his own voice present any questions in succession. Each subject was required to answer each of the twenty taped questions in at least three sentences. To help control every subject's formulation time in answering every question, a knock occurred immediately after the question was presented, which predeterminedly signaled the subject to begin answering the question immediately.

Every subject was asked to fill out a questionnaire to determine whether or not she/he recognized hearing her/his own voice and how many times, if any, the subject said she/he had heard her/his voice present a question. Each subject was also asked whether or not she/he had ever recorded her/his voice on a tape recorder, whether or not she/he had ever heard her/his voice on a tape recorder, and how recently she/he had heard her/his voice (Appendix D).

#### Apparatus

All the recordings of voice samples utilized reel to reel Wollensak tape recorders. All voice samples were recorded and played back at a consistent volume level and  $7\frac{1}{2}$  ips.

The experimental tape of the twenty questions was made for each subject, by editing into a single tape the four selected questions read by that subject in part one and the sixteen other questions read by non-experimental participants of the same sex as the subject.

While each subject was responding to the final taped twenty questions, the subject's speech responses were tape recorded. This tape of the subject's responses was utilized to determine the frequency of his disfluencies.

### Disfluency Analysis

To determine the reliability of her identification of disfluencies, the experimenter and a graduate in Speech Pathology and Audiology used Johnson, Darley and Spriestersbach's classification of disfluencies (Appendix C) to determine the frequency of disfluencies in subjects' answers to the taped questions. The judges analyzed the first twenty words of one randomly chosen response for each subject and the disfluency count of one judge was compared to that of the other by using a Pearson product-moment correlation coefficient.<sup>1</sup> The correlation coefficient was .94, which was significant at the .001 level when a two-tailed test was used, with the critical value of r

---


$$r = \frac{N\sum XY - (\sum Y)(\sum X)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$$

Where N = number of pairs of scores, XY = sum of the products of the paired scores, X = sum of scores of one variable, Y = sum of scores of other variable.

computed by using a t-test for an N value of less than thirty.<sup>2</sup> Thus, the experimenter's interjudge reliability was assumed and she analyzed the responses of every subject for disfluencies. Two scores were obtained for each subject: (a) the total number of disfluencies per one hundred words occurring during the subject's responses to questions presented in her/his own voice; and (b) the total number of disfluencies per one hundred words occurring during the subject's responses to questions presented in other voices.

Although not the prime interest of the experiment, the experimenter obtained four scores showing each subject's number of disfluencies per response to her/his own voice, to determine whether or not any adaptation occurred to hearing one's own voice.

### Statistical Design

The experimental data were analyzed using a Type I Mixed Design (Lindquist, 1956), which is a two-factor mixed design, with within-subject measures of one factor, namely, listening to own versus other voices; and with sex as a between-subject factor. An F-test was used to determine the significance of the main effects of the two factors and the interaction between them. A .10 coefficient of risk was used to determine the significance of the data since the study was exploratory in terms of determining whether or not more extensive experimentation in this area would be warranted in the future.

---


$$^2 t = r \sqrt{\frac{(N - 2)}{1 - r^2}}$$

where     r = Pearson product-moment correlation.  
           N = number of pairs of scores.



## CHAPTER III

### RESULTS

The data were analyzed by determining the total number of disfluencies per hundred words produced in a subject's speech after listening to each of four questions in her/his own recorded voice or to each of sixteen questions in other recorded voices. The mean number of disfluencies per one hundred words for every subject in each voice condition was calculated from the total number of disfluencies per hundred words produced by the subject in the two voice conditions. The mean number of disfluencies for males and females under the two voice conditions as well as the total means for sex and voice condition were determined and presented in Table 1. The groups' means were presented visually in Figure 1.

Table 2 shows the summary of the analysis of variance (Type 1 Mixed design [Lindquist, 1956]) used in evaluating the differences among the group means.

#### Interaction Effect between Voice and Sex Variables

The sex by voice interaction was not statistically significant, as indicated by an F value of .07 (df 1/18) in Table 2.

The lack of interaction between voice and sex was also illustrated in Figure 1 by the degree to which the two lines are parallel.

TABLE 1  
 MEAN NUMBER OF DISFLUENCIES FOR MALE AND FEMALE SUBJECTS  
 UNDER THE TWO CONDITIONS AND THE TOTAL MEANS  
 FOR SEX AND VOICE CONDITIONS

Groups	Voice Conditions		
	Own Voice	Other Voice	Total
Males	12.38	9.90	11.14
Females	9.88	7.81	8.84
Total	11.13	8.86	

TABLE 2  
ANALYSIS OF THE MAIN AND INTERACTION EFFECTS  
FOR SUBJECTS' DISFLUENCIES PER 100 WORDS

Source	Degrees of Freedom	Sum of Squares	Mean of Squares	F Value	p
Between Subjects	19	691.67	--	--	
Sex (A)	1	52.76	52.76	1.48	NS
Error (b)	18	638.90	35.49	--	
Within Subjects	20	159.83	--	--	
Voice (B)	1	51.26	51.26	8.78	.01
Sex by voice	1	.41	.41	.07	NS
Error (w)	18	105.07	5.83	--	
Total	39	848.407	--	--	

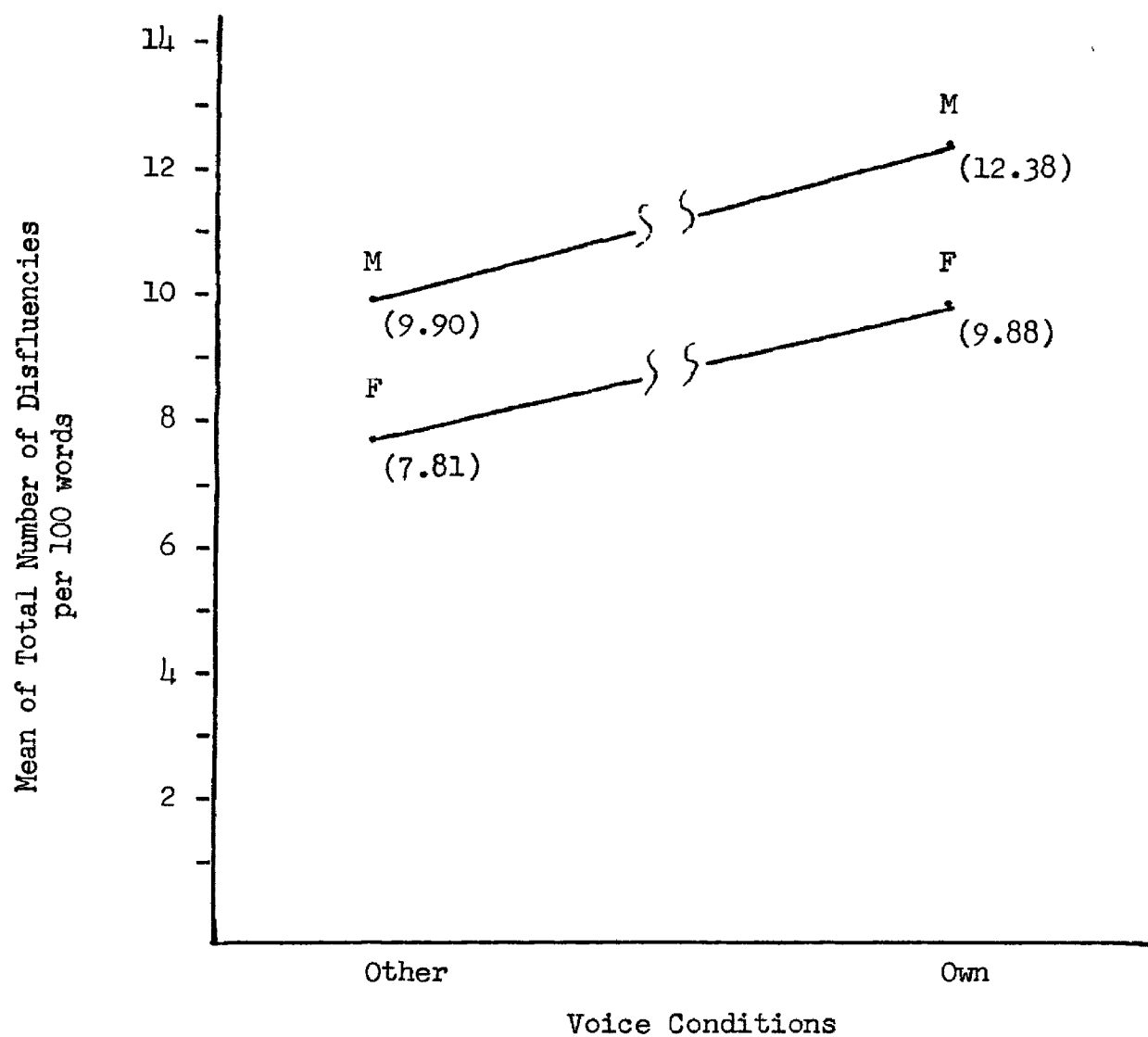


Figure 1. Relationship between sex and voice effects by comparison of mean disfluency score per 100 words for each voice condition and sex group.

Thus, the null hypothesis, which predicted no interaction effect between sex groups and voice conditions, was accepted.

### Voice Variables

To determine the main effects of hearing one's own recorded voice and hearing other recorded voices, the total subject disfluency means per hundred words for both voice conditions were compared (Table 1). The mean number of disfluencies following listening to one's own voice was 11.12, which was significantly greater than the mean number of disfluencies per hundred words resulting after listening to other recorded voices: 8.86, as indicated by an F value of 8.78 (df 1/18).

Therefore, the null hypothesis was rejected. It appears reasonable that subjects reveal more disfluencies in their speech after listening to their own recorded voices, than they would after listening to other recorded voices.

### Sex Variables

Male subjects showed a greater mean number of disfluencies (11.14) than the female subjects revealed (7.81) in their speech in general. However, the F value of 1.48 (df 1/18) was not statistically significant. Considering the lack of interaction between voice and sex and the insignificant F value for sex, the null hypothesis involving both sex groups having the same amount of disfluencies in their speech after listening to other recorded voices, was accepted. It should be pointed out that the observed difference was in the predicted direction and the general expectation that males would be more disfluent

was confirmed in the sample. The large between subject variance and the size of the sample limit the use of the result for generalization to the population unless it is interpreted with the obtained results in numerous other studies.

Adaptation Effect on Subjects' Disfluency Scores  
After Hearing Their Own and Other Voices

The experimenter was interested in whether or not the subjects showed any reduction in their disfluencies from those of the first two questions posed in their own voices to the last two questions posed in their own voices. The total number of disfluencies of each subject in his/her two responses to his/her own voice or other voices during the first ten questions and in his/her two responses to his/her own voice or other voices during the second ten questions, were calculated so the mean number of disfluencies for both sex groups and question levels in both voice conditions could be determined (Table 3).

It appears that during the first two responses to their own voices, the female subjects' disfluencies were about the same as the male subjects' disfluencies. However, in the last two responses to their own voices, the male subjects' disfluencies increased and the female subjects' disfluencies decreased. Therefore, it appears that the female subjects did adapt to hearing their own voices, while the male subjects did not show an adaptation effect to hearing their own voices (Figure 2). However, it appears that both males and females showed a reduction in their mean number of disfluencies from the first to the last ten questions, when listening to other voices. As illustrated in Figure 3, females showed a larger reduction in the mean

TABLE 3  
 MEAN NUMBER OF DISFLUENCIES PER 100 WORDS FOR MALE AND FEMALE  
 SUBJECTS IN THE TWO EXPERIMENTAL QUESTION LEVELS  
 WHEN HEARING OWN AND OTHER VOICES

Groups	Experimental Question Levels	
	First ten questions	Last ten questions
<u>Own Voice</u>		
Males	10.25	14.50
Females	11.25	8.50
<u>Other Voices</u>		
Males	10.40	9.51
Females	9.81	5.87

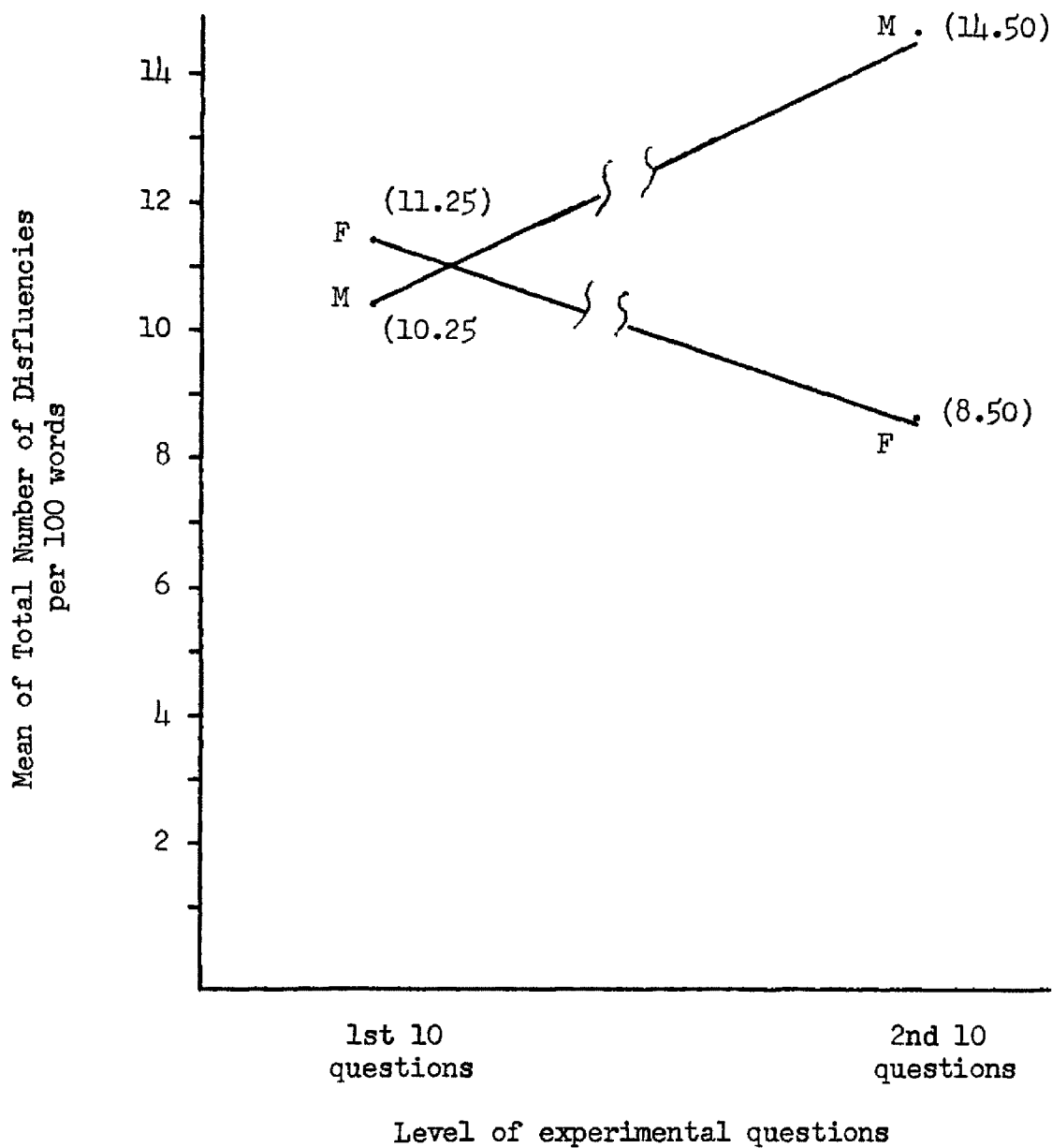


Figure 2. Relationship between the sex groups and level of experimental questions after subjects heard their own voices by comparison of the mean number of disfluencies for each sex group and experimental question level.



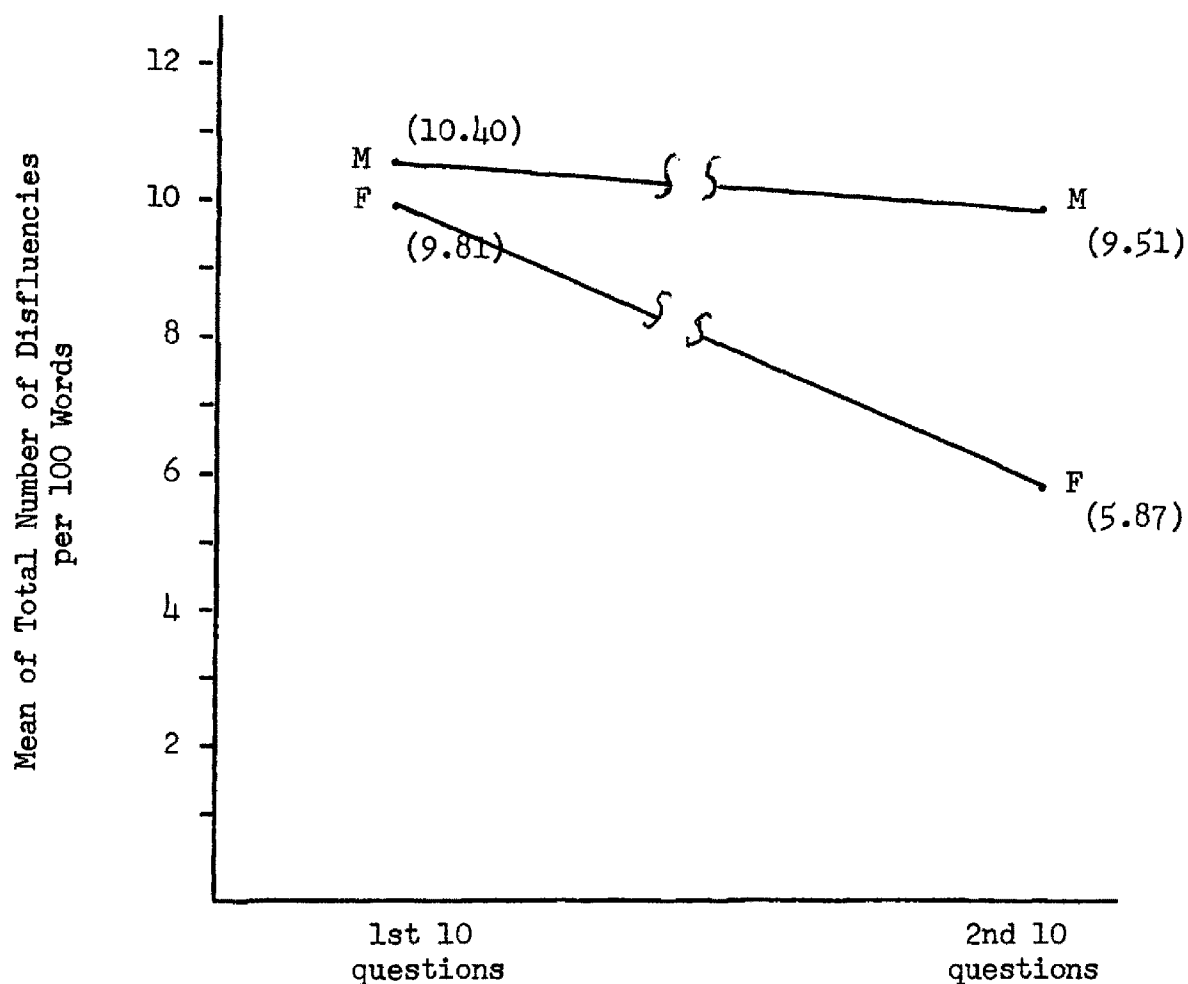


Figure 3. Relationship between the sex groups and experimental question levels after subjects hear other voices by comparison of the mean number of disfluencies for each sex group and the question level.

number of disfluencies from the first to the last ten questions, than shown by the males, suggesting adaptation to the other voice by the females and little or no adaptation by the males.

### Questionnaire Responses

All subjects in the study had more than twice previously recorded and heard their own voices on a tape recorder. Three male and five female subjects did not recognize their own voice any time on the question tape presented to them in part two of the experiment. Of these subjects, one male and one female showed a reversal in the expected number of disfluencies; they revealed more disfluencies after hearing other voices than after hearing their own voices.

With reference to Appendix E, only two subjects recognized their own voices as presented four times. Both of these subjects had heard their recorded voices several times, most recently in the past week or past month. Generally, it appeared that subjects who were able to recognize their own voices exhibited a higher amount of disfluencies after hearing their recorded voices.

## CHAPTER IV

### DISCUSSION

The hypotheses upon which this study was based were: (1) Females would show a greater change in their amount of disfluencies following hearing their own recorded voices compared to the amount of disfluencies following listening to other recorded voices, than would be revealed by males; (2) males would reveal a greater amount of disfluencies following listening to other recorded voices than the amount of disfluencies revealed by female subjects following listening to other recorded voices; (3) a larger amount of speech disfluencies would occur in a subject's speech following listening to her/his own recorded voice than would occur following listening to other recorded voices.

#### Examination of the Interaction Effect

The first hypothesis involving sex by voice interaction was not accepted by the data. In comparing responses to the two different voice conditions, it was found that males revealed slightly more change in their amount of speech disfluencies than did females, but this change was not statistically significant.

Examination of the subjects' adaptations effects to hearing their own voices may provide some understanding of why the predicted

interaction effect was not significant. Females appeared to reveal a decreased amount of speech disfluencies in their responses to the last two questions posed in their own voices, which was indicative of adaptation to hearing their own voices. Males showed increased speech disfluencies after hearing the last two questions in their own voices, which did not appear to reflect any adaptation effect.

The age of the subjects, especially the males, may have been an influencing factor on the differing adaptation effect which resulted in the present study. Some males become more conscious of their voices with the onset of puberty, for among the secondary sexual characteristics signaling the development of the reproductive capacity, the change of voice is prominent (Murphy, 1964). Such vocal variations necessitate the incorporating of new vocal techniques, new self-listening and monitoring references. New self-concepts and role perceptions may also be associated with vocal change. In females, the change of voice is not as prominent as in males and usually occurs two years before the males. Thus, many of the female subjects' voices may have already changed or have nearly finished changing, whereas some of the male subjects were entering this period of vocal change. Another indication of the males' consciousness about their voices was that more male than female subjects recognized their voices on the tape recorder, as indicated by the questionnaire. Their respective reaction to other voices may also reflect the males' greater concern about a reaction to their own voices. Females adapted in their responses to other voices as much as they did to their own voices. However, males showed little change in their response to other voices.

The experimenter based her prediction about the possible interaction effect on previous research, which indicated that women showed greater emotional reaction to hearing their own voices, than female controls revealed to hearing other voices (Holzman and Rousey, 1966). The present female subjects did initially show more speech disfluencies, after hearing their own voices, but they appeared to become more acceptant of their voices as shown by the adaptation effect. The subjects in this study were younger than those dealt with in previous studies. Older female subjects may be more conscious of physical attractiveness than younger female subjects. Perhaps older females would reveal more disfluencies after hearing their own voices than would younger females, because of their varying ideas about what constitutes attractiveness. Also, older females might be so much more concerned about their vocal attractiveness than would younger females, that they would not show the same adaptation effect as demonstrated by the female subjects in this study.

Possibly, older postpubescence males would not be as concerned about "how they sound" as is indicated in the responses of the younger male subjects studied here. Therefore, the nonsignificant interaction effect found in the present study with younger subjects should not be generalized to other age groups, without a more thorough investigation of the age variable and its effect on speech disfluencies after hearing one's own voice. Further, it is recommended that any evaluation of interaction or main effects of listening to own versus other voices should take into account adaptation effect as apparent changes were taking place during the experiment which differed for the two sexes.

### Examination of the Voice Condition Effect

The second hypothesis that one would become more disfluent after hearing his/her own voice than after hearing other recorded voices was supported by the data.

As shown in previous research (Holzman and Snyder, 1966), the subjects appeared to reveal increased tension after hearing their own recorded voices, which also appeared to occur with increased speech disfluencies (Robbins, 1920; Valyo, 1964). There are many variables which, alone or in combination, could have initiated increased tension and the resulting increased disfluencies in the subjects in the present study.

For example, the experimenter tried to control for a startle response to hearing one's own taped voice unexpectedly, by telling the subjects beforehand that they would hear their own voices, but nevertheless the subjects may have shown varying degrees of a startle response. Perhaps, any resulting emotional response to hearing one's taped voice may have been a reaction to hearing one's taped voice as differing from the voice one hears while speaking. Such a reaction appears to have occurred when people listen to their voices on a tape recorder (Holzman and Rousey, 1966). One of the explanations for such a reaction to hearing one's own taped voice, provided by Holzman and Rousey (1966) was the air versus bone conduction theory (Bekesy, 1949).

Related to the air versus bone conduction explanation is the theory of stuttering as a perpetual disturbance. As cited in Van Riper (1972), stutterers appear to possess a defective monitoring system for

producing sequential speech, which appears due to distorted auditory feedback. Motor speech requires a reliable flow of information from the output if speech is to be integrated. This feedback returns through multiple bilateral channels and is processed at many levels in the central nervous system. Thus, there are many possible sources of auditory distortions in the feedback system: asynchrony of feedback signals that arrive in the right and left cortical hemispheres and differential or delay in bone, air and tissue-conduction (Van Riper, 1972). Normal speakers monitor their motor sequences of speech by somesthesia and scan the meaning of their speech auditorily (Van Riper, 1971).

In the present study, the subjects may have utilized both their auditory and somesthetic channels to monitor their own speech after hearing their taped voices. Use of both channels, rather than only the somesthetic channel, may have caused distortion in the total feedback system and the resulting increase in speech disfluencies. If subjects switched more usage to the auditory modality than previously utilized, the switch may have occurred because of their attention focusing on the differing vocal quality resulting from hearing their taped voices through air conduction as compared to hearing their own voices while speaking through air, bone and tissue-conduction. Most of the research (Travers, 1964) seemed to indicate that when information from more than one sense modality is provided simultaneously in the governing of a given activity no advantage is given and inhibitory interference tends to be the more probatory result.

Subjects may also have shown increased disfluencies as a result of hearing disfluencies in their own recorded speech. Hanley (1972)

showed that speakers tend to become more disfluent after hearing disfluent speech. In the present study, subjects may have become more aware and less accepting of the disfluencies in their recorded speech, as compared to their reaction to disfluencies in the recorded speech of others. If such an effect was possible, then the subjects may have become increasingly aware about being disfluent and consequently become more disfluent. An increase in the males' disfluency totals in the last ten questions may have been indicative of such speech awareness. As females showed decreased disfluency totals from the first ten questions to the last ten questions, it may suggest that females may not be as susceptible to speech awareness as is suggested for the males, which may be related to the higher incidence of disfluency problems in males than in females (Davis, 1939, 1940; Johnson, 1961).

Furthermore, hearing one's own recorded voice may have caused a speaker difficulty in formulating his own subsequent speech, because of the distraction or noxiousness of the subject's own recorded vocal quality and/or his own speech disfluencies. The present subjects may have increased their speech disfluency totals by additional use of interjections and revisions, which allow additional language formulation time. Further investigations of these relationships must be clarified before generalization of these results to other populations.

#### Considerations of Other Variables Influencing Disfluency

Although interaction between experimenter and subjects was minimized through separation of the two by placing each in a sound-proof room, the experimenter was aware of the possible effect of a



female experimenter on the disfluencies produced in a subject's speech. Further experimentation may use a male experimenter to determine whether or not the sex of the experimenter is an influencing variable on the speech disfluencies of the subject after hearing his own recorded voice.

The experiment also attempted to control for equal difficulty of questions presented in both voice conditions, by consulting a curriculum adviser; but still some subjects were unable to completely answer one or two questions. When subjects did not know the answer, they usually began to answer the question and then abruptly said, "I don't know the answer," or "We haven't taken this in class." The experimenter counted these responses, when they occurred in the first twenty words of an answer. Future research, therefore, should attempt to further alleviate any language formulation difficulty, as a result of any other variable aside from the main variable of hearing one's own voice, so that the experimental findings have more generalizability to the clinical setting, than do the limitations imposed on the present study by such a language formulation variable.

### Therapeutic Considerations

The experimenter was interested in the therapeutic value of this experiment with regard to the prevention and modification of disfluency problems, as well as other speech problems. Listening to one's own speech does appear to be a variable in speech disfluencies and should be provided for in therapy, especially sessions which involve tape recorded feedback. If a clinician, working with a young articulation voice or language case, uses a tape recorder, the clinician

should be aware that the child may experience increased speech disfluencies as a function of hearing his own voice on a tape recorder. Such disfluent speech, resulting from hearing one's own taped voice, may be related to the development of disfluency problems in children. Furthermore, if a clinician is involved in work with a stutterer on a tape recorder (Peins, McGough and Lee, 1972), the stutterer's disfluencies may also increase as a function of hearing one's own recorded voice.

Such therapeutic considerations are speculation on behalf of the experimenter and should not be interpreted as generalizations of the present research findings to the clinical setting without further investigation of the experimental purpose.

#### Research Implications

As the stated intent of this study was exploratory in terms of investigating speech disfluencies as a function of hearing one's own voice, the experimenter believes that the present research findings are worthy of further investigation. Future research could delve into the following:

The effect of age and hearing one's own voice, as previously mentioned, could be considered for future experimentation. It would be interesting to note whether or not children, older teen-agers, and geriatrics exhibit disfluencies in their speech after hearing their own voices.

Research could also consider sex as an independent variable again. Do disfluencies increase as a function of hearing one's own

voice, when the age and sex of the subjects are both manipulated as another independent variable? Only future research can determine if an interaction effect between sex and voice conditions does exist in younger or older subjects.

Another consideration in investigation of disfluencies as a result of hearing one's own voice could be the speech disfluencies of various racial minorities, such as Mexican-Americans, Hutterites, American Blacks, and American Indians, to determine if their disfluencies increase after hearing their own recorded voices.

With increased use of the tape recorder directly or indirectly in stuttering therapy, the effect in a stutterer's speech of hearing her/his own recorded voice would be very valuable research in the clinical setting. As people with speech defects, other than stuttering, have been shown to react emotionally to hearing their own recorded voices (Weston and Rousey, 1970), then it appears plausible that stutterers may react in the same manner, and in turn, become more disfluent after hearing their own recorded voices. If such future research appeared significant, the clinician would benefit from being aware of the effect so that she could note the behavior, realize its stimulus and desensitize the client to the effect of hearing her/his own recorded voice.

The types of disfluencies emitted by an individual after listening to her/his own voice, may be important future research, with therapeutic implications also. If a person reveals increased interjections and revisions after hearing his/her own voice disfluencies, such disfluencies would be more likely to be regarded as "normal"

disfluencies. However, if a person showed sound and syllable repetitions and prolongations after hearing his/her own voice, his speech would more likely be considered "disfluent." Therefore, the types of disfluencies emitted by an individual, after hearing her/his own recorded voice, are important in terms of judging the speaker to be "normally" disfluent or a "stutterer," which has important implications for the judging of a stutterer in terms of his improvement.

Therefore, future research to investigate these variables in association with hearing one's own voice would be useful so that further prevention and modification of disfluency problems could occur.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

As a means of determining the effect of hearing one's own recorded voice on the fluency of a normal speaker, a group of ten male and ten female seventh graders responded to questions, which were presented in their own voice and other recorded voices. Two resulting disfluency scores were obtained from the responses of the male and female groups: the frequency of speech disfluencies shown by a subject after hearing his own voice and the frequency of disfluencies shown by a subject after hearing other recorded voices. The mean frequency of disfluencies for both sex groups in the voice conditions and the total mean frequency of disfluencies for sex and voice conditions were determined.

It was hypothesized that females would show a greater increase in their amount of speech disfluencies from the "hearing other voice" condition to the "hearing own voice" condition, compared to the male subjects. This hypothesis was not accepted, as there was no statistically significant interaction between the sex groups and voice conditions.

The null hypothesis that subjects would reveal the same amount of speech disfluencies after hearing their own recorded voices as they would reveal after hearing other recorded voices was rejected at the

.01 level of confidence. Both sexes showed a greater amount of speech disfluencies after hearing their own voices than shown after hearing other voices on a tape recorder.

The total frequency of disfluencies in the subjects' responses to questions presented in their own voices and other voices during the first ten questions were compared to like responses during the last ten questions. The female subjects appeared to adapt to hearing their own recorded voices as their frequency of disfluencies decreased from those of the first questions to those of the last questions presented in their own voices. Females adapted to hearing other voices much the same as they did to their own voices. The male subjects' frequency of disfluencies increased from the first questions to the last questions presented in their own voices. Such data insinuated that males did not adapt to hearing their own recorded voices as did the female subjects in the present study. However, males showed little change in their responses to other voices.

The null hypothesis that there would be no difference between the amount of speech disfluencies produced by males or by females after listening to other recorded voices, was not rejected. However, the results were in the predicted direction, with males showing a greater increase in their speech disfluencies than female subjects, but the change was not statistically significant.

These results appeared to agree with past research, which involved changes in a subject's reactions after hearing her/his own recorded voice. The present grade seven male and female subjects did produce more speech disfluencies after hearing their own recorded

voices, than after hearing other recorded voices. Possible explanations of this effect were discussed in terms of differing vocal quality and hearing one's own disfluencies. Although adaptation to hearing one's own voice was not the major concern of the experimenter, the study suggested that males do not adapt to hearing their own recorded voices as do female subjects. Likewise, females seemed to show greater adaptation to hearing other voices than did males. It was suggested that the age of the subjects may have influenced the males' more than the females' adaptation to hearing their own voices.

Limitations of the generalizability of the present study and implications for further research were also discussed.

## APPENDIX



## APPENDIX A

### EXPERIMENTAL INSTRUCTIONS READ BY THE SUBJECTS

Read by subjects in part one:

I would like you to read some statements for me, which are individually written on pieces of paper in front of you. Do not look at the statements until you hear a knock on the window. I will be recording these statements on a tape recorder. Begin choosing and reading aloud each statement when you hear a knock on the glass. Do not answer the statement. After reading the statement aloud, lay it aside and continue choosing and reading statements until you have read all the statements. If you have a question about these instructions, please knock on the glass.

Read by subjects in part two:

You will hear a recording of twenty questions about general knowledge, some of which you may find very easy. After hearing a question, I would like you to answer the question aloud, in at least three complete sentences. For example, the question may be, "Describe the President of the United States?" Now that is an easy question. Wait until you hear a "knock" before you answer. Your answer may be, "The President of the United States is Richard Nixon. He is about five feet, nine to ten inches, with dark hair, which is thinning. He has a prominent nose and dark eyes." Remember, always answer every

question in at least three complete sentences. The knock will signal that it is time for you to immediately answer the question. This study is not interested in your knowledge about the questions. Generally, the questions will be presented in the voices of other people, but sometimes you may hear questions presented in your own voice. If there are any questions about these instructions knock on the window.

Your first question will be presented as soon as you lay down these instructions.

## APPENDIX B

### EXPERIMENTAL QUESTIONS

Questions to read aloud by subjects in part one:

1. Describe your favorite meal and why you like it the best?
2. Tell me about the season of spring.
3. Discuss the Olympics?
4. Discuss your favorite hobbies?
5. What is the Peace Corps and Vista, now called Action, and what is its purpose?
6. What is famous about Hollywood?
7. Tell me about golf as a sport?
8. What are the two major political parties in the United States and how are they different?
9. Why do you like or dislike living in Missoula?
10. Describe the elementary school or schools which you have attended?

Questions to be read individually by nonexperimental subjects, who are in the same grade as the subjects:

1. Discuss the clubs and/or organizations to which you belong and explain their purpose?
2. Discuss the type of books and magazines in which you are interested?
3. Tell me about Washington, D.C.?
4. Discuss the type of clothing required in sub-zero temperatures?
5. What is the United Nations?
6. What is your favorite television program and why?
7. Tell me about football as a sport?

8. Describe your favorite types of animals?
9. What is your age, birthdate, place of birth and color of your eyes?
10. Describe your usual activities on a Saturday afternoon?
11. What is Moscow?
12. Describe the season of fall?
13. Who is Henry Kissinger and why is he important?
14. What do you usually eat for breakfast?
15. What is the British Commonwealth of Nations?
16. Describe a zoo?

## APPENDIX C

### CLASSIFICATION OF DISFLUENCIES

1. Interjections of Sounds, Syllables, Words or Phrases: This category includes the extraneous sounds such as "uh," "er" and "hmmm" and extraneous words such as "well" which are distinct from sounds and words associated with the fluent text or with the phenomena included in other categories.

2. Part-word Repetitions: Repetitions of parts of words--that is, syllables and sounds--are placed in this category. E.g., "cuh-some" or "ba-ba-baby."

3. Word Repetitions: Repetitions of whole words, including words of one syllable, are counted in this category. A word repeated for emphasis as in "very, very nice," is not considered a disfluency. A part-word repetition, or an interjection, does not nullify a word repetition.

4. Phrase Repetition: Repetitions of two or more words are included in this category. E.g., "I was I was going."

5. Revisions: Instances in which the content of a phrase is modified, or in which there is grammatical modification, are classified in this category. Change in the pronunciation of a word is also counted as a revision. E.g., "I was--I am going."

6. Incomplete Phrases: This category involves a phrase in which the thought or content is not completed; and which is not an instance of phrase repetition or of revision. "She was--and after she got there he came."

7. Broken Words: This category is typified by words which are completely pronounced and which are not classifiable in any other category, or in which the normal rhythm of the word is broken in a way that definitely interferes with the smooth flow of speech. E.g., "I was g(pause)--ing home."

8. Prolonged Sounds: Sounds or parts of words that are judged to be unduly prolonged are included in this category.

Based on Johnson, Darley and Spriestersbach (1963).

## APPENDIX D

### QUESTIONNAIRE FILLED OUT BY THE SUBJECTS AFTER COMPLETION OF THE EXPERIMENT

1. In the previous experiment, did you recognize your own voice in the questions presented? Yes \_\_\_\_\_ No \_\_\_\_\_
2. If your answer is yes, how often did you hear your own voice present a question? Once \_\_\_\_\_ Twice \_\_\_\_\_ Three \_\_\_\_\_ Four \_\_\_\_\_ Five \_\_\_\_\_ More than Five \_\_\_\_\_
3. Have you ever recorded your voice on a tape recorder before? Yes \_\_\_\_\_ No \_\_\_\_\_
4. How many times have you had your voice recorded on a tape recorder before? Never \_\_\_\_\_ Once \_\_\_\_\_ Twice \_\_\_\_\_ Three to Five \_\_\_\_\_ More than Five \_\_\_\_\_
5. Have you heard your voice on a tape recorder before? Yes \_\_\_\_\_ No \_\_\_\_\_
6. How many times have you heard your voice on a tape recorder? Never \_\_\_\_\_ Once \_\_\_\_\_ Twice \_\_\_\_\_ Three to Five \_\_\_\_\_ More than Five times \_\_\_\_\_
7. When was the last time you heard your voice on a tape recorder? Never \_\_\_\_\_ Last Week \_\_\_\_\_ Last Month \_\_\_\_\_ During last six months \_\_\_\_\_ During last year \_\_\_\_\_ Several years ago \_\_\_\_\_

Thank you for your cooperation in this experiment. Do not talk about what you did in the experiment or wrote on this questionnaire, until everyone has participated in the experiment.

# APPENDIX E

## AVERAGE NUMBER OF DISFLUENCIES IN BOTH VOICE CONDITIONS FOR TWENTY SUBJECTS AND THEIR RESPECTIVE RESPONSES ON THE QUESTIONNAIRE

Groups	Voice Conditions				Questionnaire Responses			
	Own Voice		Other Voices		No. of "own voice" pre-sentations recognized	No. of previous voice recordings	No. of times heard own recorded voice	Last time heard own recorded voice
	First Ten Questions	Last Ten Questions	First Ten Questions	Last Ten Questions				
<u>Males</u>								
1.	2.5	5.0	5.0	3.75	2	3-5	3-5	last month
2.	10.0	32.5	11.25	13.75	2	more 5	>5	last week
3.	10.0	2.0	20.63	15.63	never	3-5	3-5	6 months
4.	2.5	7.5	6.25	5.63	2	3-5	2	last month
5.	10.0	15.0	4.38	10.63	never	>5	>5	last month
6.	12.5	15.0	12.5	10.0	4	>5	>5	last week
7.	27.5	15.0	16.25	13.75	1	>5	3-5	last year
8.	12.5	15.0	6.88	6.25	3	>5	>5	last 6 mo.
9.	5.0	5.0	3.13	5.63	1	>5	>5	last month
10.	10.0	15.0	16.88	10.0	never	>5	>5	last month
<u>Females</u>								
1.	5.0	22.5	6.25	9.38	3	>5	>5	Several yrs. ago
2.	15.0	10.0	6.87	7.22	never	>5	>5	last month
3.	12.5	10.0	12.5	6.25	never	3-5	2	last week
4.	15.0	2.5	6.87	5.0	4	>5	3-5	last month
5.	10.0	5.0	9.38	5.63	3	3-5	3-5	last week
6.	12.5	2.5	6.25	1.88	never	>5	>5	last month
7.	10.0	2.5	8.13	3.13	1	>5	>5	last week
8.	20.0	15.0	16.25	4.38	never	3-5	3-5	last year
9.	7.5	5.0	7.25	7.5	never	3-5	3-5	last week
10.	5.0	10.0	9.38	7.5	3	>5	>5	last week

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